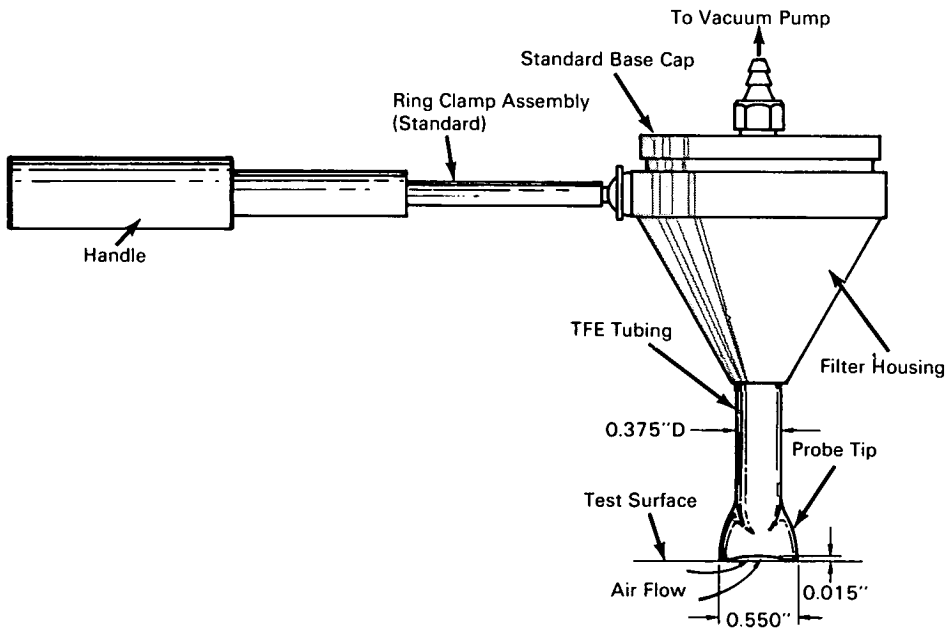
AEC-NASA TECH BRIEF

Vacuum Probe Sampler Removes Micron-Sized Particles from Surfaces



The problem:

To assay the microbial contamination of large surfaces without depositing residual nutrient materials on the surface being assayed (as is the case with agar plating and agar contact methods), or without diluting the sample or leaching out substances toxic to the culturing medium (as with the swab-rinse and rinse methods). Even vacuum removal of bacteria or other micron-sized particles is difficult because the boundary layer of air near the surface tends to hold the small particles within its lower regions.

The solution:

A vacuum probe having a critical orifice to ensure an optimum airflow rate that disturbs the boundary layer of air and raises bacteria from the surface into the probe with the moving air stream. Once the bacteria have been caught by the moving air, they are carried on through the probe and may be treated as airborne particles.

How it's done:

TFE tubing with a tip orifice shaped as shown in the illustration is held perpendicular against a flat surface to be sampled. Airflow into the orifice at the rate of two cubic feet per minute efficiently removes more than 90 percent of the bacteria with diameters as small as one micron from a smooth surface without harming the surface. A flanged portion of the tip provides an orifice clearance of 0.015 inch from the surface being sampled. For the indicated airflow rate, this orifice is of the required critical configuration for most efficient removal of bacteria from surfaces.

(continued overleaf)

Notes:

1. With the vacuum probe's orifice operating in the critical condition, the air molecules are accelerated very rapidly from a relatively slow velocity just outside the tip to a very high velocity turbulent flow just inside the tip. This rapid flow transition generates some amount of ultrasonic energy at the orifice. This energy release at the orifice could have an effect on the removal of small particles from the surface. Calculations show that it is possible for a microorganism to be dislodged by sonic vibration.
2. Its ability to remove micron-sized particles from sensitive surfaces, without damage to the surface, renders it useful for cleaning, sampling, and monitoring in sterile environments such as hospitals and pharmaceutical houses. The rapid airflow rate, combined with the ultrasonic energy, is capable of removing particles held by static electricity. Because of the probe's small size, it could be used with miniaturized items or delicate assemblies.
3. Inquiries concerning this innovation may be directed to:

   Sandia Office of Industrial
   Cooperation Org. 3413
   Sandia Corporation
   Post Office Box 5800
   Albuquerque, New Mexico 87115
   Reference: B68-10231

Patent status:

No patent action is contemplated by AEC or NASA.

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